REPORT

ON YEARLY INSPECTION OF CONCRETE TEST SPECIMENS AT TREAT ISLAND CONTAINING FLY ASH, SILICA FUMES AND SLAG FOR THE

DEPARTMENT OF ENERGY, MINES & RESOURCES

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1. Introduction

On August 12, 1982, the Department of Supply and Services awarded a contract to the Department of Civil Engineering of the University of New Brunswick for the yearly inspection of concrete test specimens at Treat Island, Maine, U.S.A. The work statement is given in Appendix A.

2. Identification, Labeling and Rearrangement of Test Specimens

The concrete test prisms at Treat Island are listed in Table 1. Specimens A01 to L07 inclusive were at Treat Island at the time the inspection was carried out. Specimens M01 to O04 were cast but had not been transported to Treat Island. The prisms were first cleaned of sea weed and silt with metal scrapers and wire brushes. The prisms were identified and stainless steel bands placed around them at mid length. The stainless steel strap was cut about 100 mm longer than the distance around the prisms. This allowed a free end of about 40 mm on each side of the metal clip that was used to secure the strap. The long axis of the prisms were at right angles to the shore and the markings were stamped on the straps so that they could be read by a person looking at the prism from the sea side.

The free end of the strap was stamped with an identifying code on it while the other (underlying) free end had a code composed of notches and punched holes. The identifying letter and numbers from Table I were stamped on the top free end of the strapping using machinest's steel stamping irons. The other free end was notched and punched so as to produce the identifying code shown in Table II. In addition to the above a tag 140 x 150 mm was prepared. It consisted of a piece of wood siding on which was stapled a plastic paper label containing the information in Table 1 for each of the specimens. A typical label is shown in Figure 1. The plastic paper and the wooden back-up was intended as a temporary identification, only while the tide was out. They are to be collected before the tide comes in and serve only as identification when visitors come to the site. The plastic paper and waterproof markers were from Canlab Ltd., Halifax, N.S. and were stock item numbers P1152-20 and P1226-1 respectively.

3. Pulse Velocity Measurements

The nondestructive examination of concrete prisms utilized a battery powered "V-meter" manufactured by James Electronics (Chicago, Ill) Serial No. T68542. The meter was calibrated to a reference bar at 26.3 μ sec. at the beginning and periodically throughout the testing.

Fifty millimeter diameter transducers were used with a coupling medium made from kalonite and glycerin oil.

Five readings were taken of each specimen and recorded in Table III. The readings were as follows:

No. 1	top right
No. 2	top left
No. 3	bottom left
No. 4	bottom right
No. 5	centre

The above are based on looking at the labelled end (sea side) of the prism. The location of readings on specimen A01 are as follows:

At Treat Island the labelled end of the specimens is on the sea side so the observer would be standing on the sea side of the specimen and looking towards the shore.

Additional readings were taken on specimens M1 to R4 respectively using the Department of Energy, Mines and Resources ultrasonic pulse velocity meter (CANMET #10 PUNDIT). This meter gave 1% higher readings when calibrated on its own calibration rod and then applied to the

"V-meter" calibration rod. The results are given in Table IV.

4. Photographic and Colour Slide Record

Two cameras were used to obtain color slides and prints. One camera was an Argus-Cosina 35 mm camera with either a 50 mm Argus Cosina f1.7 or 70 - 210 mm. f 4 lens. The other camera was a Pentax MX 35 mm with a Takamar f 1.4 lens, with skylight filter.
A separate roll of film was used for a given series of specimens so that the colour tone did not change for a particular set of concrete mix variables. The slides are in Appendix B and are labeled SA01 for the slide of specimen A01. The photographs are in Appendix C and are labeled PA01 for photograph A01. An extra set of slides and photographs has been stored in room B19, Head Hall, University of New Brunswick, Fredericton for future reference.

5. Nature and Degree of Deterioration

Extensive deterioration of only two specimens (SP3 and SP6) has taken place at this time. The extent of deterioration can be seen by noting pluse velosity readings in Table III and the photographs PSP3, PSP6, SSP3 and SSP6. These specimens are the non-air-entrained concrete

specimens containing superplasticizers. This is a result of exposure to four years of freezing and thawing in sea water. The control specimen SP4 with the same water cement ratio (W/C = 0.5) and also without any air-entraining agent appears to be in good condition.

A general trend towards increasing surface deterioration can be noted in all specimens with increasing replacement of cement with fly ash and slag and is most noted in specimens C10 and C11 which have a water cement ratio of 0.6 and 65% replacement of cement with slag. Specimens placed one year later (F10 and F11) and with the same water cement ratio show about the same or slightly more deterioration when 20% of the cement is replaced with fly ash and 60% is replaced with slag.

Wiebenga has pointed out in a paper "Durability of Concrete Structures Along the North Sea Coast of the Netherlands" which was published in the American Concrete Institute publication SP-65 that "slag cement appears to be more susceptible to surface damage (up to 5-10 mm depth) due to frost than portland cement concrete is. For frost damage in the interior of the concrete the effect appears to be reversed". The surface deterioration that he refers to is quite evident after four years when specimen C01 is compared with the C02, C06 and C10. It is

also evident after three years when specimen F01 is compared with F02, F06 and F10. The specimens with the second and third digits ending in 01 have no slag or fly ash whereas 02, 06 and 10 have increasing replacement of cement with fly ash and/or slag.

6. Conclusion

In view of the limited number of years that the specimens have been at the exposure site it would appear prudent to wait a little longer before making specific recommendations. The variables investigated are such that deterioration is on the threshold of proceeding rapidly and to obtain maximum information the specimens should be examined and studied closely over the next decade. During that time the effect of mix proportion, cement type and the role of supplementary cementing materials should become evident.

It is of prime importance to maintain adequate labeling and documentation of the specimens at the site so that should a storm disrupt the installation the specimens can be identified and repositioned.

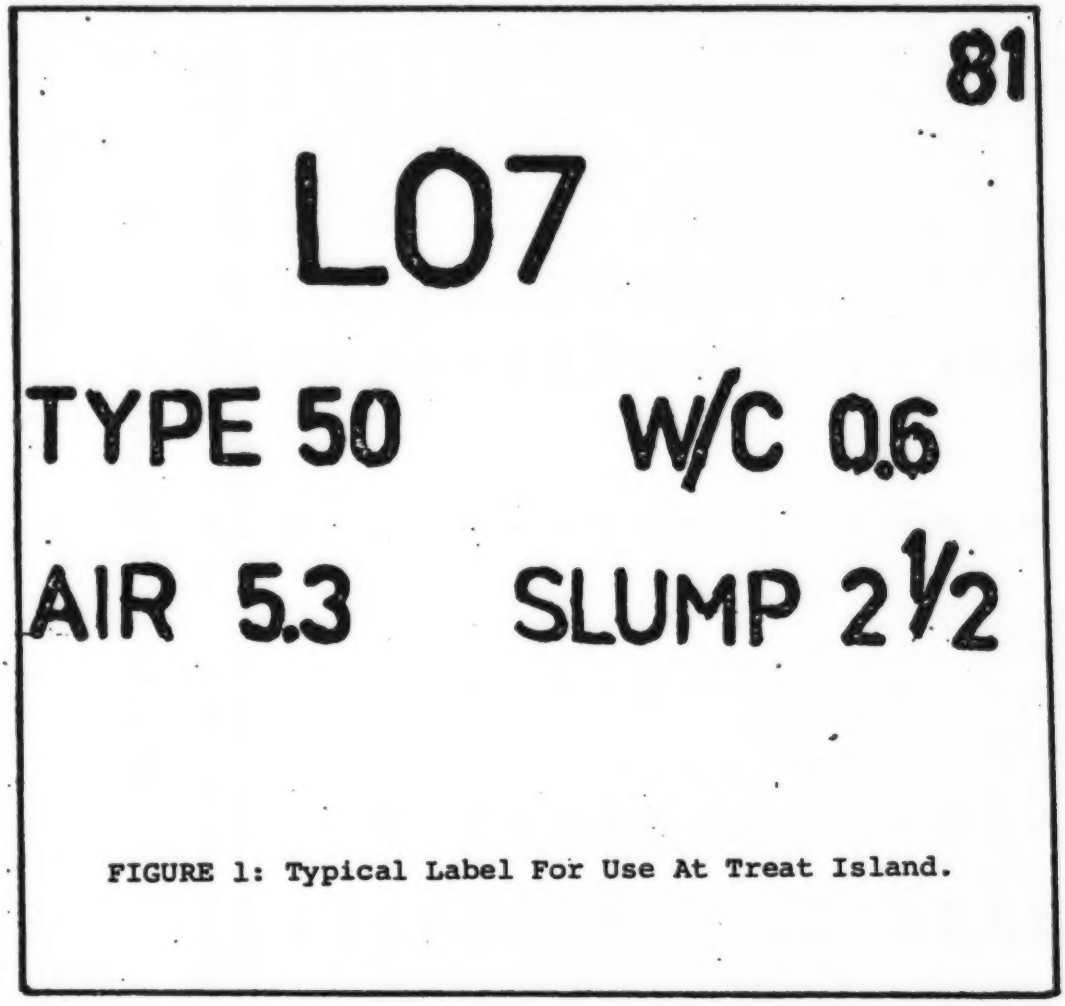


FIGURE 1: Typical Label For Use At Treat Island.

TABLE I

Description of Specimens

SERIES	% SLAG	% F.A.	% S.F.	WT OF CEMENT	WT OF SLAG	WT OF FLY ASH	WT OF SILICA FUMES	CEMENT TYPE	W/C	SLUMP	AIR CONTENT	UNIT WT	YEAR CAST	REMARKS
A01	0	0	0	667	0	0	0	10	0.4	2 3/4	5.6	146	1978	
A02	25	0	0	492	164	0	0	10	0.4	2 1/4	7.0	144	1978	
A03	25	0	0	536	179	0	0	10	0.4	3 1/2	6.6	143	1978	
A05	0	0	0	749	0	0	0	10	0.4	3 1/2	6.5	145	1978	
A06	45	0	0	410	336	0	0	10	0.4	2 7/8	6.8	145	1978	
A07	45	0	0	409	335	0	0	10	0.4	2 1/4	6.4	144	1978	
A09	0	0	0	750	0	0	0	10	0.4	3 5/8	5.8	145	1978	
A10	65	0	0	260	483	0	0	10	0.4	2 1/4	6.0	144	1978	
A11	65	0	0	262	489	0	0	10	0.4	3	6.4	141	1978	
A13	0	0	0	661	0	0	0	50	0.4	2 3/4	6.2	146	1978	
B01	0	0	0	551	0	0	0	10	0.5	3 1/2	6.5	144	1978	
B02	25	0	0	413	138	0	0	10	0.5	3 7/8	6.7	143	1978	
B03	25	0	0	417	139	0	0	10	0.5	3 5/8	5.9	144	1978	
B05	0	0	0	539	0	0	0	10	0.5	3 3/8	5.5	148	1978	
B06	45	0	0	308	253	0	0	10	0.5	3	6.4	144	1978	
B07	45	0	0	308	252	0	0	10	0.5	2 3/4	6.8	144	1978	
B09	0	0	0	565	0	0	0	10	0.5	3	6.5	146	1978	
B10	65	0	0	196	363	0	0	10	0.5	3	7.0	144	1978	
B11	65	0	0	197	366	0	0	10	0.5	2 1/2	5.6	145	1978	
B13	0	0	0	530	0	0	0	50	0.5	3 3/8	6.2	146	1978	

TABLE I - continued

SERIES	% SLAG	% F.A.	% S.F.	WT OF CEMENT	WT OF SLAG	WT OF FLY ASH	WT OF SILICA FUMES	CEMENT TYPE	W/C	SLUMP	AIR CONTENT	UNIT WT	YEAR CAST	REMARKS
C01	0	0	0	476	0	0	0	10	0.6	3 1/2	5.8	147	1978	
C02	25	0	0	353	118	0	0	10	0.6	3 7/8	6.4	145	1978	
C03	25	0	0	353	118	0	0	10	0.6	4	5.5	146	1978	
C05	0	0	0	450	0	0	0	10	0.6	3	5.7	145	1978	
C06	45	0	0	248	203	0	0	10	0.6	3	5.2	145	1978	
C07	45	0	0	244	200	0	0	10	0.6	3 1/2	6.5	143	1978	
C09	0	0	0	448	0	0	0	10	0.6	3 1/2	5.4	145	1978	
C10	65	0	0	158	293	0	0	10	0.6	3 5/8	5.5	145	1978	
C11	65	0	0	157	292	0	0	10	0.6	3 5/8	5.2	144	1978	
C13	0	0	0	458	0	0	0	50	0.6	3 7/8	5.4	148	1978	
SP1	0	0	0	563	0	0	0	10	0.5	3 1/4	5.6	146	1978	
SP2	0	0	0	559	0	0	0	10	0.5	Collapse	6.3	145	1978	
SP3	0	0	0	587	0	0	0	10	0.5	Collapse	0.9	152	1978	
SP4	0	0	0	588	0	0	0	10	0.5	2 3/8	1.5	152	1978	
SP5	0	0	0	557	0	0	0	10	0.5	Collapse	6.2	144	1978	
SP6	0	0	0	581	0	0	0	10	0.5	Collapse	0.3	150	1978	

TABLE I - continued

SERIES	% SLAG	% F.A.	% S.F.	WT OF CEMENT	WT OF SLAG	WT OF FLY ASH	WT OF SILICA FUMES	CEMENT TYPE	W/C	SLUMP	AIR CONTENT	UNIT WT	YEAR CAST	REMARKS
D01	0	0	0	665	0	0	0	10	0.4	2 1/8	6.0	151	1979	
D02	0	25	0	473	0	158	0	10	0.4	3	6.2	143	1979	
D03	0	25	0	473	0	158	0	10	0.4	2 1/4	6.4	143	1979	
D05	0	0	0	693	0	0	0	10	0.4	2 1/8	5.3	147	1979	
D06	40	20	0	271	271	135	0	10	0.4	2	6.4	142	1979	
D07	40	20	0	271	271	135	0	10	0.4	2 1/2	5.8	142	1979	
D09	0	0	0	693	0	0	0	10	0.4	3 1/8	5.7	147	1979	
D10	60	20	0	139	416	139	0	10	0.4	2 1/8	6.2	144	1979	
D11	60	20	0	142	424	142	0	10	0.4	2 3/8	5.5	142	1979	
D13	0	0	0	648	0	0	0	50	0.4	4	6.6	146	1979	
D16	0	0	0	624	0	0	0	20	0.4	3 1/4	5.4	148	1979	
E01	0	0	0	540	0	0	0	10	0.5	4	5.2	147	1979	
E02	0	25	0	404	0	135	0	10	0.5	3 3/4	5.2	146	1979	
E03	0	25	0	389	0	130	0	10	0.5	4	6.6	144	1979	
E05	0	0	0	502	0	0	0	10	0.5	4	5	148	1979	
E06	40	20	0	216	216	108	0	10	0.5	3 1/4	6.9	145	1979	
E07	40	20	0	205	205	102	0	10	0.5	3 7/8	6.3	143	1979	
E09	0	0	0	501	0	0	0	10	0.5	3 3/8	5.6	147	1979	
E10	60	20	0	96	289	97	0	10	0.5	3 3/4	6.9	143	1979	
E11	60	20	0	99	297	99	0	10	0.5	3 3/8	6.2	144	1979	
E13	0	0	0	512	0	0	0	50	0.5	2	5.5	148	1979	
E16	0	0	0	501	0	0	0	20	0.5	2 1/8	6.8	144	1979	

TABLE I - continued

SERIES	% SLAG	% F.A.	% S.F.	WT OF CEMENT	WT OF SLAG	WT OF FLY ASH	WT OF SILICA FUMES	CEMENT TYPE	W/C	SLUMP	AIR CONTENT	UNIT WT	YEAR CAST	REMARKS
F01	0	0	0	414	0	0	0	10	0.6	3 1/8	5.3	148	1979	
F02	0	25	0	306	0	102	0	10	0.6	4	5.2	146	1979	
F03	0	25	0	293	0	98	0	10	0.6	3 1/2	6.7	143	1979	
F05	0	0	0	392	0	0	0	10	0.6	2 1/4	6.5	144	1979	
F06	40	20	0	164	164	82	0	10	0.6	3 3/4	6.5	144	1979	
F07	40	20	0	165	165	82	0	10	0.6	4	6.5	143	1979	
F09	0	0	0	381	0	0	0	10	0.6	3	6.5	142	1979	
F10	60	20	0	77	231	77	0	10	0.6	3 1/4	6.4	144	1979	
F11	60	20	0	77	230	76	0	10	0.6	3	6.5	143	1979	
F13	0	0	0	379	0	0	0	50	0.6	2 1/4	6.0	146	1979	
F16	0	0	0	353	0	0	0	20	0.6	3	6.9	142	1979	

TABLE I - continued

SERIES	% SLAG	% F.A.	% S.F.	WT OF CEMENT	WT OF SLAG	WT OF FLY ASH	WT OF SILICA FUMES	CEMENT TYPE	W/C	SLUMP	AIR CONTENT	UNIT WT	YEAR CAST	REMARKS
G01	0	0	0	404	0	0	0	10	0	2 3/4	6.0	119	1980	
G03	25	0	0	308	103	0	0	10	0	3	6.5	120	1980	
G04	25	0	0	310	104	0	0	10	0	3 1/4	5.2	120	1980	
G06	0	0	0	406	0	0	0	10	0	2 1/2	6.1	119	1980	
G07	45	0	0	228	187	0	0	10	0	2 1/4	5/4	121	1980	
G08	45	0	0	225	184	0	0	10	0	2 3/4	6.5	119	1980	
G10	0	0	0	403	0	0	0	10	0	2 1/2	6.6	118	1980	
G11	65	0	0	142	264	0	0	10	0	3 1/2	7.0	118	1980	
G12	65	0	0	144	267	0	0	10	0	3	5.7	119	1980	
G14	0	0	0	406	0	0	0	50	0	3 1/2	5.6	119	1980	
H01	0	0	0	600	0	0	0	10	0	3	5.6	121	1980	
H03	25	0	0	452	151	0	0	10	0	3	6.0	121	1980	
H04	25	0	0	444	148	0	0	10	0	3 3/4	7.0	119	1980	
H06	0	0	0	595	0	0	0	10	0	3	6.0	121	1980	
H07	45	0	0	333	273	0	0	10	0	3 1/2	6.7	120	1980	
H08	45	0	0	335	274	0	0	10	0	3 1/4	6.8	120	1980	
H10	0	0	0	598	0	0	0	10	0	3	6.8	121	1980	
H11	65	0	0	217	403	0	0	10	0	3	6.8	120	1980	
H12	65	0	0	216	401	0	0	10	0	2 3/4	6.0	121	1980	
H14	0	0	0	594	0	0	0	50	0	3 1/8	7.0	119	1980	

TABLE I - continued

SERIES	% SLAG	% F.A.	% S.F.	WT OF CEMENT	WT OF SLAG	WT OF FLY ASH	WT OF SILICA FUMES	CEMENT TYPE	W/C	SLUMP	AIR CONTENT	UNIT WT	YEAR CAST	REMARKS
I01	0	0	0	798	0	0	0	10	0	3 1/4	5.8	120	1980	
I03	25	0	0	606	202	0	0	10	0	3 1/4	6.3	121	1980	
I04	25	0	0	611	204	0	0	10	0	3	5.8	121	1980	
I06	0	0	0	799	0	0	0	10	0	2 1/2	5.7	120	1980	
I07	45	0	0	440	360	0	0	10	0	2 7/8	5.5	119	1980	
I08	45	0	0	440	360	0	0	10	0	3 1/4	5.6	119	1980	
I10	0	0	0	791	0	0	0	10	0	3 1/2	7	119	1980	
I11	65	0	0	279	518	0	0	10	0	3 3/4	6	117	1980	
I12	65	0	0	285	529	0	0	50	0	3 1/4	5.5	120	1980	
I14	0	0	0	783	0	0	0	10	0	3	6.9	119	1980	

TABLE I - continued

SERIES	% SLAG	% F.A.	% S.F.	WT OF CEMENT	WT OF SLAG	WT OF FLY ASH	WT OF SILICA FUMES	CEMENT TYPE	W/C	SLUMP	AIR CONTENT	UNIT WT	YEAR CAST	REMARKS
J01	0	0	0	741	0	0	0	10	0.40	3 5/8	6.6	146	1981	
J02	0	0	0	741	0	0	0	10	0.40	3 1/4	6.6	146	1981	
J04	0	25	0	536	0	179	0	10	0.40	4	7.0	141	1981	
J05	0	25	0	514	0	171	0	10	0.40	3 1/8	6.8	145	1981	
J07	0	0	0	723	0	0	0	50	0.40	3 1/8	5.0	151	1981	
K01	0	0	0	586	0	0	0	10	0.50	3	5.5	148	1981	
K02	0	0	0	583	0	0	0	10	0.50	3 1/8	6.2	147	1981	
K04	0	25	0	412	0	137	0	10	0.50	2 3/4	5.2	147	1981	
K05	0	25	0	404	0	135	0	10	0.50	2 1/2	6.1	147	1981	
K07	0	0	0	525	0	0	0	50	0.50	3 3/4	6.0	149	1981	
L01	0	0	0	444	0	0	0	10	0.60	3	6.0	148	1981	
L02	0	0	0	438	0	0	0	10	0.60	4.0	6.0	147	1981	
L04	0	25	0	309	0	103	0	10	0.60	3 1/8	6.1	147	1981	
L05	0	25	0	310	0	103	0	10	0.60	3 1/2	5.8	149	1981	
L07	0	0	0	412	0	0	0	50	0.60	2 1/2	5.3	150	1981	

TABLE I - continued

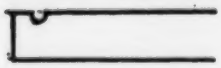
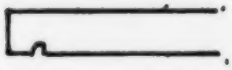
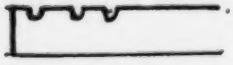
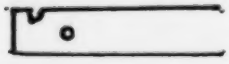
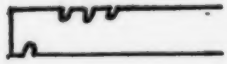
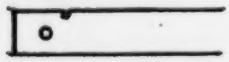
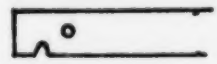
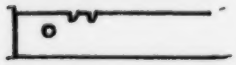
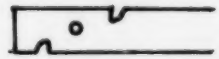
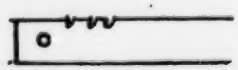
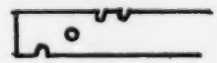
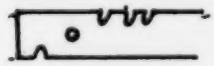
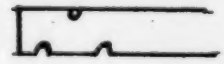
SERIES	% SLAG	% F.A.	% S.F.	WT OF CEMENT	WT OF SLAG	WT OF FLY ASH	WT OF SILICA FUMES	CEMENT TYPE	W/C	SLUMP	AIR CONTENT	UNIT WT	YEAR CAST	REMARKS
M01	0	0	0	734	0	0	0	10	0.4	95mm	6.5	144	1982	
M02	0	0	0	746	0	0	0	10	0.4	89	5.9	146	1982	
M03	80	0	0	150	601	0	0	10	0.4	82	5.8	146	1982	
M04	80	0	0	149	596	0	0	10	0.4	95	6.2	145	1982	
N01	0	0	0	554	0	0	0	10	0.5	88	6.3	148	1982	
N02	0	0	0	552	0	0	0	10	0.5	70	5.6	147	1982	
N03	80	0	0	109	436	0	0	10	0.5	82	6.0	145	1982	
N04	80	0	0	108	431	0	0	10	0.5	98	6.7	143	1982	
O01	0	0	0	434	0	0	0	10	0.6	88	5.2	147	1982	
O02	0	0	0	437	0	0	0	10	0.6	75	5.5	147	1982	
O03	80	0	0	85	340	0	0	10	0.6	108	6.3	143	1982	
O04	80	0	0	86	344	0	0	10	0.6	102	6.1	145	1982	
P01	0	0	0	439	0	0	0	10	0.6	82	6.4	145	1982	
P02	0	0	10+	434	0	0	43	10	0.6	73	6.5	143	1982	
P03	0	0	15+	441	0	0	66	10	0.6	78	5.3	146	1982	
P04	0	0	20+	437	0	0	88	10	0.6	92	6.3	144	1982	

TABLE I - continued

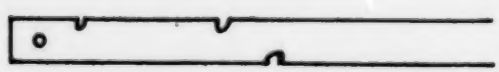
SERIES	% SLAG	% F.A.	% S.F.	WT OF CEMENT	WT OF SLAG	WT OF FLY ASH	WT OF SILICA FUMES	CEMENT TYPE	W/C	SLUMP	AIR CONTENT	UNIT WT	YEAR CAST	REMARKS
Q01	0	0	0	409	0	0		10	0.6	75	6.3	144	1982	
Q02	0	0	10	368	0	0	41	10	0.6	65	6.4	145	1982	
Q03	0	0	15	347	0	0	61	10	0.6	84	6.5	144	1982	
Q04	0	0	20	330	0	0	83	10	0.6	72	6.0	145	1982	
R01	0	0	0	468	0	0	0	10	0.6	50	1.5	150	1982	
R02	0	0	10	432	0	0	48	10	0.6	88	1.1	154	1982	
R03	0	0	15	405	0	0	72	10	0.6	100	0.9	152	1982	
R04	0	0	20	381	0	0	95	10	0.6	83	1.1	152	1982	

TABLE II

Specimen Identification Code

Letter	Number	Code	Letter	Number	Code
A	01		J	10	
B	02		K	11	
C	03		L	12	
D	04		M	13	
E	05		N	14	
F	06		O	15	
G	07		P	16	
H	08		Q	17	
I	09		R	18	
			SP	19	

Example

F09 

F | 09

TABLE III

Ultrasonic Pulse Velocity Readings

	1	2	3	4	5	
PRISM NO.	TOP RIGHT	TOP LEFT	BOTTOM LEFT	BOTTOM RIGHT	CENTRE	REMARKS
A01	201.9	203.1	201.0	203.0	203.4	
A02	213.5	211.7	203.4	206.3	215.9	
A03	212.5	213.9	208.0	207.7	213.8	
A05	205.9	205.1	200.8	206.3	207.6	
A06	209.2	209.9	204.6	201.6	217.8	
A07	214.8	209.3	206.4	208.3	218.0	
A09	207.9	206.5	204.4	200.1	208.9	
A10	208.4	207.0	205.4	201.7	220.8	
A11	210.4	211.4	207.4	206.8	223.8	
A13	204.4	203.7	197.8	198.8	206.0	
B01	213.9	216.5	204.2	204.1	211.5	
B02	215.0	215.6	211.0	209.5	214.5	
B03	214.4	209.9	203.7	208.3	215.0	
B05	213.2	211.0	204.6	201.2	213.1	
B06	215.6	215.9	203.6	204.5	216.6	
B07	210.9	213.7	206.5	204.6	214.3	
B09	213.6	216.9	211.5	209.5	216.3	
B10	240.1	215.4	208.5	211.3	223.0	
B11	217.8	208.9	323.4	200.8	222.5	
B13	210.9	209.7	204.9	200.6	209.2	
C01	211.7	211.4	210.9	211.1	217.6	
C02	213.8	212.7	208.4	210.5	215.5	
C03	215.4	214.7	210.1	206.3	217.1	
C05	217.6	218.9	206.1	207.4	214.0	
C06	215.0	214.1	207.4	205.9	214.4	
C07	215.6	215.5	205.7	208.5	218.2	
C09	218.5	216.0	208.6	207.8	214.8	
C10	222.0	225.7	211.6	213.0	217.4	
C11	299.5	224.7	296.8	322.3	219.4	
C13	215.1	219.0	198.4	200.4	214.1	
SP1	214.3	213.0	207.7	209.9	216.5	
SP2	218.2	216.6	213.3	212.0	218.2	
SP3	-	210.4	-	-	214.3	
SP4	201.2	213.0	209.1	202.4	202.5	
SP5	209.5	208.7	206.9	207.6	212.0	
SP6	-	-	-	-	-	

TABLE III - continued

PRISM NO.	1 TOP RIGHT	2 TOP LEFT	3 BOTTOM LEFT	4 BOTTOM RIGHT	5 CENTRE	REMARKS
D01	210.6	215.6	208.5	208.8	211.5	
D02	216.6	218.9	212.1	212.6	216.6	
D03	216.0	217.4	213.1	212.8	214.2	
D05	205.1	208.1	204.6	203.6	207.7	
D06	215.7	211.2	210.6	214.1	225.3	
D07	420.2	217.1	213.1	214.4	226.1	
D09	214.6	208.8	208.2	206.5	209.4	
D10	448.5	-	324.5	319.4	438.6	
D11	325.8	433.0	430.5	-	501.1	
D13	213.6	215.8	210.1	211.4	214.8	
D16	210.1	209.4	201.5	205.5	208.8	
E01	211.6	209.4	204.3	308.4	213.0	
E02	214.3	218.2	320.7	326.0	215.3	
E03	222.6	227.4	326.5	312.4	219.0	
E05	209.6	215.6	210.3	209.3	209.8	
E06	222.1	222.8	327.8	624.9	231.1	
E07	222.1	223.1	202.5	212.0	222.8	
E09	209.9	211.1	204.4	209.5	212.9	
E10	-	448.2	436.3	324.0	239.5	
E11	-	-	219.1	227.1	236.6	
E13	209.8	206.6	205.8	209.1	211.7	
E16	215.9	215.1	211.3	206.5	215.4	
F01	217.4	219.1	211.1	209.5	216.6	
F02	221.4	223.1	215.1	214.0	221.1	
F03	223.8	231.4	217.4	228.7	224.1	
F05	216.9	222.5	213.4	219.4	223.3	
F06	225.1	-	-	-	483.4	
F07	236.1	247.1	220.1	211.9	238.6	
F09	231.4	265.9	219.3	218.6	224.4	
F10	-	-	-	-	412.0	
F11	-	-	-	-	-	
F13	216.1	215.5	214.6	211.7	217.7	
F16	224.6	226.1	220.0	219.5	224.4	

TABLE III - continued

	1	2	3	4	5	
PRISM NO.	TOP RIGHT	TOP LEFT	BOTTOM LEFT	BOTTOM RIGHT	CENTRE	REMARKS
G01	501.5	-	248.3	245.1	-	
G03	529.6	489.8	361.6	364.8	632.7	
G04	297.4	264.5	363.4	508.7	447.7	
G06	266.5	246.1	243.1	367.9	244.5	
G07	360.6	359.6	464.6	256.6	276.6	
G08	326.4	484.6	482.3	361.1	529.6	
G10	393.9	249.6	265.1	244.8	-	
G11	-	-	-	-	-	
G12	-	719.3	-	-	445.6	
G14	243.2	277.8	373.9	368.4	-	
H01	234.5	239.7	234.5	231.3	238.8	
H03	232.1	233.7	231.4	251.9	234.0	
H04	237.0	258.7	234.4	238.1	237.5	
H06	236.5	240.0	227.8	231.7	254.2	
H07	253.6	254.6	229.0	234.5	250.9	
H08	252.8	252.6	252.6	252.4	252.8	
H10	237.8	235.9	236.1	253.1	234.6	
H11	255.0	227.5	228.6	229.5	288.5	
H12	252.7	253.5	232.1	232.5	246.3	
H14	235.0	234.0	233.9	253.4	236.1	
I01	230.7	228.7	229.4	247.1	232.3	
I03	229.8	254.6	227.1	230.0	230.5	
I04	230.5	249.7	224.5	225.3	227.1	
I06	231.8	252.4	228.5	227.7	232.6	
I07	231.5	234.1	228.1	228.9	229.7	
I08	231.6	229.9	251.0	227.8	231.4	
I10	232.1	234.9	250.4	248.6	233.1	
I11	234.4	232.3	228.7	253.1	287.8	
I12	234.6	250.2	230.6	228.9	250.0	
I14	229.6	228.7	227.6	230.2	229.0	
J01	223.8	202.4	200.1	199.7	201.1	
J02	199.6	205.1	197.4	193.8	199.6	
J04	208.7	191.3	202.4	200.3	204.6	
J05	201.5	202.7	200.0	198.4	204.2	
J07	195.1	197.0	194.5	191.4	197.7	

TABLE III - continued

	1	2	3	4	5	
PRISM NO.	TOP RIGHT	TOP LEFT	BOTTOM LEFT	BOTTOM RIGHT	CENTRE	REMARKS
K01	202.4	203.5	197.0	196.9	200.2	
K02	203.5	205.9	195.9	196.5	203.0	
K04	197.2	198.5	214.6	195.8	197.9	
K05	204.9	203.9	197.6	196.3	201.7	
K07	205.1	207.6	201.3	198.6	202.7	
L01	209.4	209.2	199.3	193.8	204.3	
L02	209.8	213.2	206.0	205.1	207.9	
L04	210.6	210.9	194.6	202.3	208.9	
L05	203.9	205.3	202.5	201.2	204.9	
L07	210.5	209.4	205.8	203.8	212.9	
M1	200.5	199.4	194.1	192.5	199.5	
2	200.8	198.7	194.1	195.2	199.2	
3	203.4	204.6	198.6	200.1	213.6	
4	209.6	208.0	198.6	199.6	212.5	
N1	205.5	203.6	198.8	199.0	204.6	
2	200.0	199.1	197.3	196.5	200.0	
3	212.9	211.2	203.0	202.1	214.1	
4	215.8	218.5	206.3	205.7	222.1	
O1	203.4	204.6	200.1	201.3	205.5	
2	206.5	207.4	202.6	203.1	206.0	
3	222.6	221.1	209.8	208.6	218.4	
4	913.3	217.4	204.4	205.0	214.0	
P1	209.8	208.4	201.4	200.6	207.5	
2	203.0	204.6	204.0	204.4	206.6	
3	202.1	200.7	201.4	200.3	203.6	
4	207.5	206.0	202.6	202.5	206.1	
Q1	208.9	210.8	201.4	208.6	210.6	
2	208.0	206.4	203.6	201.5	205.8	
3	207.7	208.8	207.1	205.2	201.8	
4	208.0	207.9	203.0	203.4	207.7	
R1	191.8	180.7	192.0	192.0	190.6	
2	191.0	192.7	192.3	190.0	190.6	
3	195.5	193.3	191.0	191.9	194.6	
4	195.0	195.0	194.1	195.7	193.9	

TABLE IV

Ultrasonic Pulse Velocity Readings

Using CANMET #10 Pundit Meter

	1	2	3	4	5	
PRISM NO.	TOP RIGHT	TOP LEFT	BOTTOM LEFT	BOTTOM RIGHT	CENTRE	REMARKS
M1	200.5	202.1	196.8	195.5	201.0	
2	200.0	199.5	195.6	195.5	200.5	
3	205.0	206.8	201.1	201.6	214.6	
4	211.6	210.2	200.3	201.4	213.5	
N1	206.9	204.2	199.8	200.4	206.3	
2	199.8	202.0	198.6	199.3	202.5	
3	214.0	213.0	204.6	204.3	215.6	
4	219.7	218.8	208.1	207.2	222.0	
O1	205.7	206.6	202.5	204.3	208.7	
2	207.9	207.0	201.6	205.6	207.1	
3	220.9	222.4	213.1	211.1	219.6	
4	216.0	217.3	207.0	206.2	215.0	
P1	210.8	209.6	203.8	203.0	209.0	
2	204.0	208.0	206.0	205.0	207.7	
3	201.5	203.2	202.9	201.5	205.2	
4	208.7	208.7	204.3	203.8	207.4	
Q1	210.7	214.0	209.0	211.0	213.6	
2	209.2	208.7	204.2	203.3	206.6	
3	209.6	210.8	206.7	204.6	209.0	
4	209.4	208.8	204.0	204.6	209.6	
R1	192.3	191.8	192.8	195.0	192.2	
2	191.7	193.1	190.6	190.5	192.7	
3	196.1	194.8	192.0	193.0	195.4	
4	195.6	196.4	195.0	195.5	196.5	

DSS FILE: 19SV.23440-2-911

SERIAL NO: OSV82-00002

APPENDIX "A"

STATEMENT OF WORK

The Contractor shall travel to Treat Island and test and inspect more than 100 flyash/slag/concrete test blocks which have been installed at Treat Island (a facility operated by U.S. Corps of Engineers) during the last four years.

The Contractor shall carry out the following:

(a) a report on the visual inspection of each block with proper identification of the blocks;

(b) pulse velocity determination of test blocks;

(c) photographic (and colour slides) record of the deteriorated blocks, and nature and degree of deterioration;

(d) a detailed report of the testing and inspection;

(e) rearrangement of the test specimens after the inspection.

APPENDIX B

SLIDES OF CONCRETE SPECIMENS

APPENDIX C

COLOUR PRINTS OF CONCRETE SPECIMENS

POOR

QUALITY

ORIGINAL